**Alien Enzyme Invasion – Teacher’s Guide**

**1) Purpose**

The purpose of this lab is to provide a visual experience for students involving enzyme activity. Since these reactions normally occur within cells, it is a concept that many students may not be able to understand how these reactions occur. It is also important to illustrate to students that enzymes have an optimal range in which to function. By manipulating environmental factors, this allows students to

**2) Concepts**

The concepts covered in this laboratory include:

* Enzymes and substrates
* Enzymatic reactions
* Influence of environmental factors on enzymatic activity

**Objectives**

TSWBAT Define an enzyme and a substrate

TSWBAT Observe that enzymes are not used up in reactions

TSWBAT Investigate how changes in the environment can affect enzyme activity.

**Illinois Standards:** Stage I 12 A1 & A2

**3) Materials/Preparation Guide**

Materials (per student group)

1 test tube rack

6 test tubes

Test tube clamp

Tray

Stop watch (optional for timing)

10ml graduated cylinder

Marker for test tubes

For the entire class:

Alien Enzyme solution:

Blend fresh beef liver into a solution. You may alternatively simply slice the liver and give slices to each group; reactions may not be as significant though.

2 500ml beakers (used for ice and hot water baths)

pH buffers (3, 7, 10)

3 250ml beakers for pH buffers

Hot plate

Ice

2 thermometers

Hydrogen peroxide- enough for 7 groups

**4) Time/Length of Lab**

This laboratory should take forty to forty five minutes. Instructor prep time should take roughly 20 minutes to blend the liver and pour into test tubes for students. Alternatively, you could have students measure out the enzyme solution for each test tube from a single beaker filled with the liver solution.

**5) Safety Issues**

Safety goggles should be worn since students will be working around heated glassware. Students should also be advised to not directly touch hot glassware and assume that all glassware near the heating apparatus is very hot.

**6) Pre/Post Lab Discussion Guide**

**Pre:** Introduce the problem that there is a secret alien invasion going on. Explain that the only way to defeat these aliens is to figure out how to stop a vital enzyme from functioning and thus not allowing the aliens to survive. A brief view of enzymes can be discussed prior to students starting the lab.

**Post:** Have students clean up their materials. After all the students have cleaned up their supplies, engage students in a discussion about what they observed during the experiment. Topics you can discuss and or provide explanations about can include

pH environment- Enzymes require a certain pH range to function in an optimal way. Changes in the pH level can cause the enzyme to denature and alter its active site, which would not allow it to correctly interact with the substrate.

Temperature- Like pH, temperature plays a key role in enzyme activity. If the temperature becomes too hot, the enzyme becomes denatured and unwinds, unable to carry out its function.

Enzyme structure and function

**7) Special Notes**

Liver needs to be fresh, cooked liver will destroy the enzymes. The liver does not need to be pureed to get results, small pieces will work as well but will add to prep time to prepare.

**Students with Special Needs** – if needed, students will have materials brought to them and assisted with handling hot glassware. Some students may be given additional time to complete the activity if needed.

**8) Diagram**

Students should work in groups of 2-4 for this laboratory.

Instruct students to rinse out their graduate cylinders when pouring pH buffers to insure they get accurate results.

On trays, have the following ready for each group

Test tube rack

6 test tubes (you can save time by having them already filled with the liver solution)

Test tube clamp

Marker for test tubes

Stop watch (optional)

Solution management:

Prior to the class, have an ice bath and a hot water bath prepared. The hot water bath should be approximately 100°C and the ice bath should be at least 0°C.

pH buffers will need to be poured into their respective beakers for students to take as needed. Keep the pH buffer bottles nearby to quickly replenish any stock.

Keep the Hydrogen peroxide in a closed container. Have students take it as they need.

All student materials should be thrown out in a designated container to be disposed of at the end of the lab. Liver will begin to smell bad over time and worsen the longer sits, so just throw it away as soon as possible.

Students should wash out all test tubes at the end of their lab activity.

Example of room set up:

pH buffers

Extra supplies

Student work area( trays and hydrogen peroxide at each station)

1 2

3 4

5 6

7

Hot water bath

Ice bath

Front of the Room